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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/916,021	07/26/2001	Chien-Ping Huang	71987-10000	8130
21874	7590	01/14/2004	EXAMINER	
EDWARDS & ANGELL, LLP			CHU, CHRIS C	
P.O. BOX 9169			ART UNIT	
BOSTON, MA 02209			PAPER NUMBER	
			2815	

DATE MAILED: 01/14/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 09/916,021	<b>Applicant(s)</b> HUANG ET AL.	
	<b>Examiner</b> Chris C. Chu	<b>Art Unit</b> 2815	<i>mw</i>

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 21 October 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1 - 10 and 21 - 30 is/are pending in the application.
- 4a) Of the above claim(s) 23 - 30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 - 10, 21 and 22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All    b) ☐ Some \* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                  | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### ***Request for Continued Examination***

1. A request for continued examination (RCE) under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 21, 2003 has been entered. An action on the RCE follows.

### ***Response to Amendment***

2. Applicant's amendment filed on September 29, 2003 has been received and entered in the case.

### ***Election/Restrictions***

3. Newly submitted claims 23 – 30 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons:

- I. Claims 1 – 10, 21 and 22, drawn to a semiconductor package with a heat sink, classified in class 257, subclass 706.
- II. Claims 23 - 30, drawn to a fabrication method of a semiconductor package with a heat sink, classified in class 438, subclass 1+.

The inventions are distinct, each from the other because of the following reasons:

a. Inventions II and I are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be made by a materially different process such as attaching a plurality of solder balls on the lower surface of the chip carrier module plate without implanting the solder balls, such as a plurality of alloyed or regular solder balls.

b. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, have acquired a separate status in the art because of their recognized divergent subject matter, and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 23 – 30 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

*Claim Rejections - 35 USC § 102*

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 2, 4 – 6, 9, 10, 21 and 22 are rejected under 35 U.S.C. 102(e) as being anticipated by Distefano '915.

Regarding claim 1, Distefano discloses in e.g., Fig. 4, Fig. 8N, Fig. 8O, column 9, lines 30 - 47 and column 15, lines 1 – 17 a semiconductor package with a heat sink, comprising:

- a chip carrier (5);
- at least one chip (2) mounted on a surface of the chip carrier (5) and electrically connected (by the element 6) to the chip carrier;
- a heat sink (10, the invar layer in multi-layer of the element 10) having a first surface, a second surface opposed to the first surface, and a plurality of side surfaces interconnecting the first surface and the second surface, wherein the first surface of the heat sink is attached to the chip for interposing the chip between the chip carrier and the heat sink;
- an interface layer (10, the upper Cu layer in multi-layer of the element 10) formed on the second surface of the heat sink, and made of a material having adhesion with a molding compound smaller than adhesion between a heat sink and a molding

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compound (see the paragraph 10 of this Office action), wherein the interface layer covers the entire second surface of the heat sink; and

- an encapsulant (3) made of the molding compound, wherein the interface layer (10, the upper Cu layer in multi-layer of the element 10) and the side surfaces of the heat sink (10, the invar layer in multi-layer of the element 10) are exposed to outside of the encapsulant, and the molding compound left on the interface layer during formation of the encapsulant is easily removable from the interface layer (see column 15, lines 1 – 17), so as to make the semiconductor package free of flash of the molding compound because of the relatively smaller adhesion between the interface layer and the molding compound.

Regarding claim 2, Distefano discloses in e.g., Fig. 4 the heat sink having a surface area dimensionally same as that of the chip carrier.

Regarding claim 4, Distefano discloses in e.g., Fig. 4 the chip carrier being a substrate.

Regarding claim 5, Distefano discloses in e.g., Fig. 4 a chip (2) being electrically connected to a substrate (5) through bonding wires (6).

Regarding claim 6, Distefano discloses in e.g., Fig. 5 the chip (2) being electrically connected to the substrate through solder bumps (11a).

Regarding claim 9, since Distefano does not disclose grinding the surface of the heat sink, the surface thereof is inherently roughened, corrugated or made uneven.

Regarding claim 10, Distefano discloses in e.g., Fig. 4 at a position on the first surface of the heat sink corresponding to the chip (2) there is formed a connecting portion (9) extending toward the chip (2) for connecting the heat sink (10, the invar layer in multi-layer of the element

10) to the chip (14) through the connecting portion (see e.g., Fig. 4), and the first surface of the heat sink (10, the invar layer in multi-layer of the element 10) other than the position of the connecting portion being spaced apart from the chip.

Regarding claim 21, Distefano discloses in e.g., Fig. 4 a buffer pad (9) being interposed between the chip (2) and the heat sink (10, the invar layer in multi-layer of the element 10), and made of a material having a similar thermal expansion coefficient to the chip (see column 9, lines 31 - 33).

Regarding claim 22, Distefano discloses in e.g., Fig. 6 a plurality of solder balls (13) implanted on a surface of the chip carrier (5) opposite to the surface mounted with the chip (2).

### ***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Distefano in view of Kato et al. '801.

Distefano discloses the claimed invention except for the material for making the interface layer being nickel. However, Kato et al. teaches in e.g., Fig. 12 and column 5, lines 57 - 62 a material for making the interface layer being nickel. Thus, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to modify Distefano by using

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nickel as the material for making the interface layer as taught by Kato et al. The ordinary artisan would have been motivated to modify Distefano in the manner described above for at least the purpose of increasing strength and toughness of the semiconductor package at elevated temperature.

8. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Distefano in view of Huang et al. '171.

Distefano discloses the claimed invention except for the chip carrier being a QFN (quad flat nonlead) lead frame and wherein the chip being electrically connected to the QFN lead frame through bonding wires. However, Huang et al. discloses in Figs. 1 ~ 7 and column 3, lines 30 ~ 31 a chip carrier being a QFN (quad flat nonlead) lead frame and wherein the chip being electrically connected to the QFN lead frame through bonding wires (216 in Fig. 6 and 316 in Fig. 7). Thus, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to modify Distefano by using the QFN (quad flat nonlead) lead frame and the bonding wires as taught by Huang et al. The ordinary artisan would have been motivated to modify Distefano in the manner described above for at least the purpose of improving the heat-dissipating effect of the package (column 2, lines 8 ~ 10).

#### ***Response to Arguments***

9. Applicant's arguments with respect to claim 1 have been considered but are moot in view of the new ground(s) of rejection.



***Conclusion***

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Stetson et al. '613 discloses in column 4, lines 54 – 60 the invar forming strong bonds with insulating material than copper with insulating material.

Davidson et al., Kato and Solberg disclose a semiconductor package.

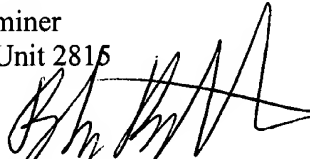
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chris C. Chu whose telephone number is (703) 305-6194. The examiner can normally be reached on M-F (10:30 - 7:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone number for the organization where this application or proceeding is assigned is (703) 308-7382.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

c.c.  
1/9/04 7:34:55 PM

Chris C. Chu  
Examiner  
Art Unit 2815



**BRADLEY BAUMEISTER  
PRIMARY EXAMINER**